

PCTWORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : G21F 5/005	A1	(11) International Publication Number: WO 98/16936 (43) International Publication Date: 23 April 1998 (23.04.98)
(21) International Application Number: PCT/SE97/01658 (22) International Filing Date: 3 October 1997 (03.10.97) (30) Priority Data: 9603757-7 15 October 1996 (15.10.96) SE (71)(72) Applicant and Inventor: JOHANSSON, Gert [SE/SE]; Kohlsva Gjuteri AB, P.O. Box 101, S-730 30 Kolsva (SE). (74) Agent: BERGGREN, Björn; Långrevsgatan 1, S-723 49 Västerås (SE).		(81) Designated States: JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>In English translation (filed in Swedish).</i>
(54) Title: METHOD OF MANUFACTURING OBLONG CAPSULES (57) Abstract <p>The present invention relates to a method of manufacturing oblong canisters for storing spent nuclear fuel elements. This method is characterized in that a bundle of tubes (2) the length of the canister are joined together to form a parcel, by means of welding for instance, around which parcel a casing (9) of metal is cast.</p> <div data-bbox="997 1142 1344 1604"></div>		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

Method of manufacturing oblong capsules.

Technical field:

The present invention relates to a method of manufacturing oblong
5 canisters for storing spent nuclear fuel elements.

Background art:

Casting long objects with internal cavities while retaining the
straightness of the cavities is problematical. This applies particularly to
10 canisters for storing spent nuclear fuel elements. When complete such
canisters shall be sealed at the ends and surrounded by an outer casing
of copper. This is a method known per se, but it is important that the
cavities in the canisters are straight. Furthermore, the casting may not
be too complicated and thus expensive.

15

Description of the invention:

The method according to the invention aims at solving these problems
and is characterised in that a bundle of tubes the length of the canister
are joined together to form a parcel around which a casing of metal is
20 cast. According to this method sand cores or other types of nuclear
material are replaced when the cavities are cast. Straight cavities are
obtained in a simple and efficient manner. Tubes having square or
round cross section or tubes of some other cross section may be used in
the parcel to be joined together, by welding for instance.

25

In a suitable embodiment, for instance, twelve square tubes are used
which are joined together and fixed in the desired grouping, by welding
for instance, or bracing between the tubes, after which the tube parcel is
filled with filler as required, e.g. ladle lining, and pre-heated. The pre-
30 heated tube parcel is placed in the lower part of a casting mould and the
other parts of the mould are positioned, after which casting of the
casing is performed in vertical position, or horizontal position if its size
permits, and with casting gates at different levels, for instance. The
metal used is steel SS 1306, for instance, or some other material. The
35 canister shall be long, having a length:diameter ratio of between 3:1 and

6:1, but other ratios are also possible. Equipment can be built for extreme proportions.

5 One advantage with the method is that strict straightness tolerances or other tolerances for the canister can be obtained and, of course, that the canister can be produced at all. The requirement (in the case of square tubes) may be that a gauge with dimensions 153:153:4500 shall be passed through the cavity of the canister.

10 The finished canister shall primarily be used for storing spent nuclear fuel elements or other material and shall be sealed all around and at the ends in known manner with an outer casing of copper.

Brief description of the drawings:

15 The method according to the invention is exemplified in the accompanying drawings. Figure 1 shows a longitudinal section of a canister to be cast and Figure 2 shows the same canister in cross section. Figure 3 shows a cross section through a parcel of square tubes.

20 **Description of embodiment:**

Figures 1 and 2 show a finished canister, in this case a parcel of twelve square tubes (2) which have been welded together to a parcel and filled with filler, after which pre-heating may be performed if necessary. The ratio between the canister length (L) and its diameter (D) is here 4.9:1.

25 When the fuel elements have been placed in the canister it shall be surrounded by an outer casing of copper (1) and end pieces of the same material.

30 The welded parcel of tubes (Figures 1 and 2) is placed upright and fixed in the lower part or core of a casting mould. The other parts of the mould are positioned and the casting in steel is performed in vertical or horizontal position, e.g. through casting gates at different levels. The material of the tubes is normally steel, SS 1312, and the casting is performed in steel with a wall thickness of 10 mm. When the casting
35 body has cooled the ladle lining is emptied out. One or more casting

gates can be used at one or more levels, determined by casting weight, dimensions, etc.

Figure 3 shows the square tubes and the straight cavities (2) with
5 bracing (5) welded between the tubes (2). After insertion of the
elements the canister is enclosed in copper in known manner.

The method according to the invention can be varied in many ways
within the scope of the following claims.

CLAIMS

1. A method of manufacturing an oblong canister for storing spent nuclear fuel elements, characterized in that a bundle of tubes (2) the length of the canister are joined together to form a parcel around which a casing (9) of metal is cast.
2. A method as claimed in claim 1, characterized in that a number of tubes (2) are welded together as bracing (5) between the tubes, after which the parcel of tubes is filled with filler, e.g. ladle lining, and pre-heated if necessary.
3. A method as claimed in claim 2, characterized in that the pre-heated tube parcel is secured in the lower part of a casting mould and the other parts are positioned, after which casting of the casing is performed in vertical position.
4. A method as claimed in claims 1-3, characterized in that the welded parcel (2) consists of a number of square tubes.
5. A method as claimed in any of the preceding claims, characterized in that the tubes are straight and/or parallel with each other.
6. A method as claimed in claims 1-3, characterized in that the casting is performed at different levels.
7. A method as claimed in any of the preceding claims, characterized in that the casing (9) consists of steel SS 1306.

FIG. 1

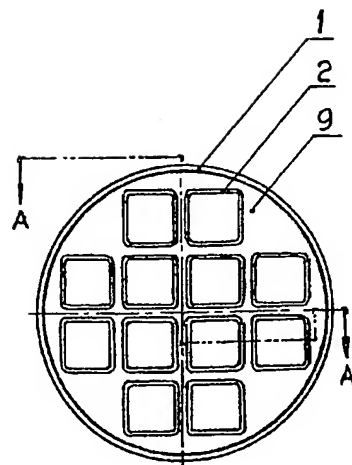
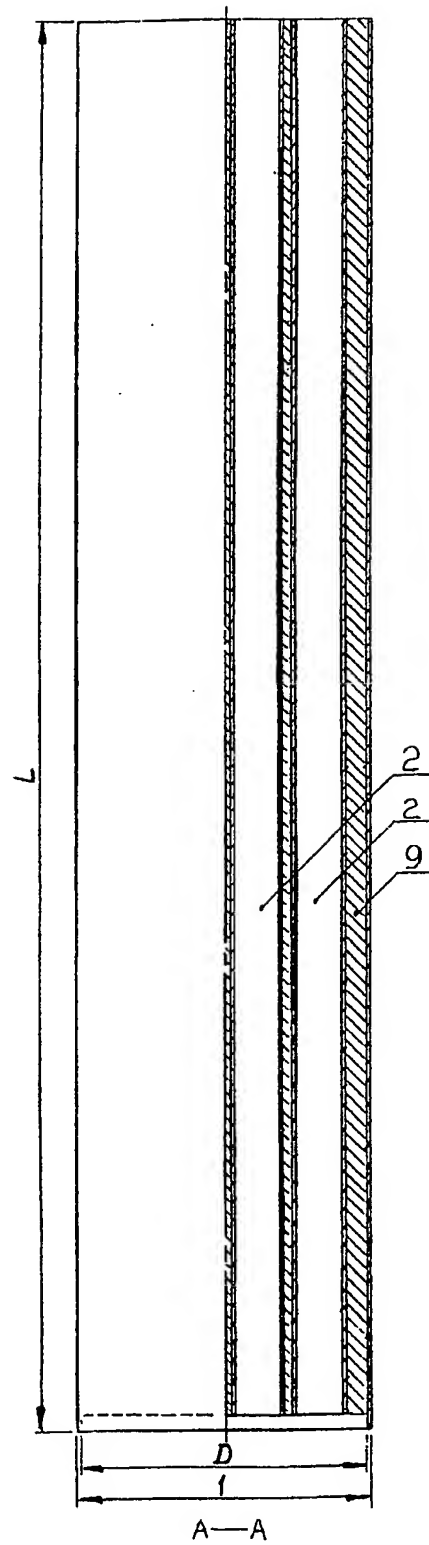
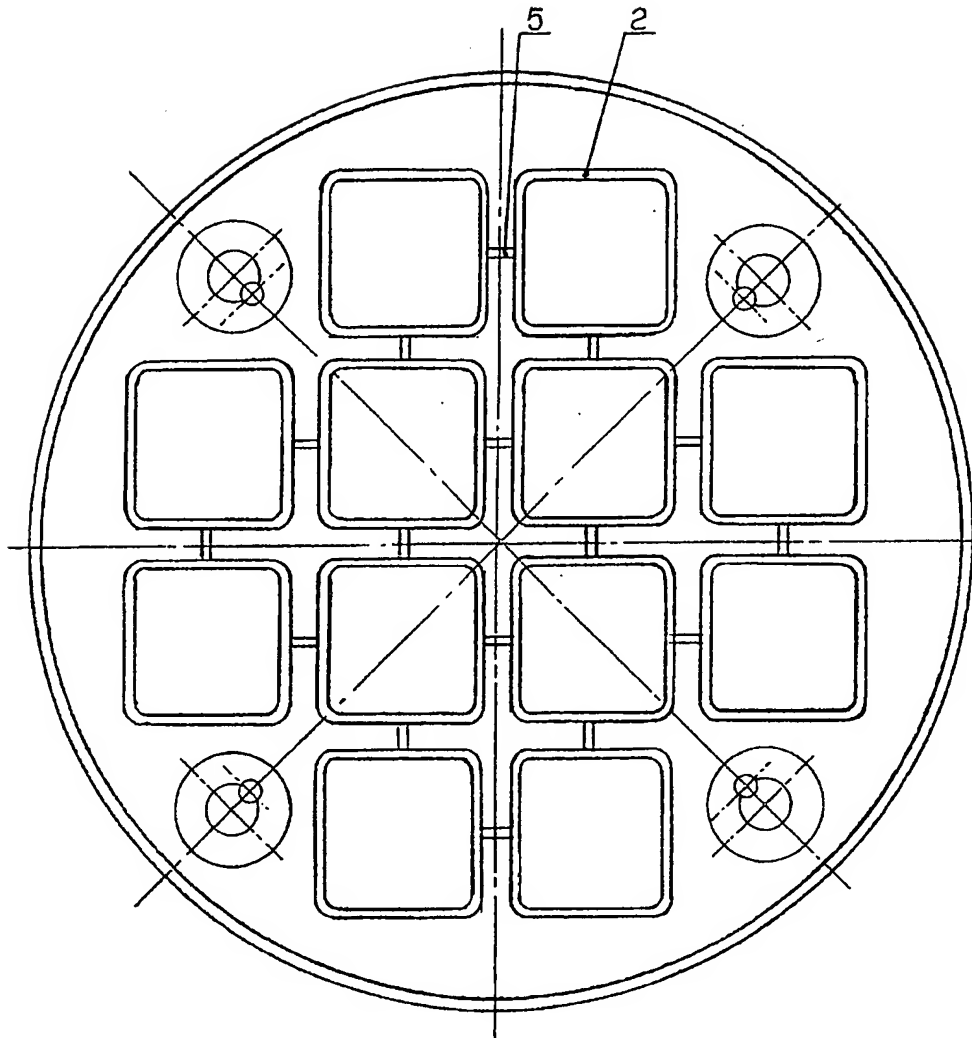


FIG. 2



FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/01658

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: G21F 5/005 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: G21F, B22D, C23C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
WPI		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9526030 A1 (TRANSNUCLEAIRE S.A.), 28 Sept 1995 (28.09.95), figures 1-4, abstract --	1-7
A	DE 3140020 A1 (KERNFORSCHUNGSZENTRUM KARLSRUHE GMBH), 21 April 1983 (21.04.83), figures 1,2, abstract --	1-7
A	WO 9526029 A1 (TRANSNUCLEAIRE), 28 Sept 1995 (28.09.95), figure 1, abstract --	1-7
A	US 5550882 A (LEHNERT ET AL), 27 August 1996 (27.08.96), figure 1, abstract -- -----	1-7
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
14 January 1998		04 -02- 1998
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Tomas Lund Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/97

International application No.

PCT/SE 97/01658

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9526030 A1	28/09/95	DE 663706 T DE 69500741 D EP 0663706 A,B EP 0752151 A ES 2079340 T FR 2715004 A,B JP 7235349 A US 5611707 A ZA 9502084 A	02/05/96 00/00/00 19/07/95 08/01/97 16/01/96 13/07/95 05/09/95 18/03/97 12/03/96
DE 3140020 A1	21/04/83	FR 2514545 A,B GB 2109984 A,B JP 58072100 A	15/04/83 08/06/83 28/04/83
WO 9526029 A1	28/09/95	CZ 9602744 A EP 0752150 A FR 2717945 A,B ZA 9502420 A	15/01/97 08/01/97 29/09/95 16/01/96
US 5550882 A	27/08/96	AU 7972694 A CN 1117322 A EP 0673541 A FI 952817 A JP 8507382 T US 5438597 A WO 9510838 A ZA 9407869 A	04/05/95 21/02/96 27/09/95 08/06/95 06/08/96 01/08/95 20/04/95 09/04/96